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COMPLETE SPECIFICATION

Improvements in Radiated Energy Absorbing Materials

We, ELTRO G.M.B.H., & CO., GESELLSCHAFT FUR STRAHLUNGSTECHNIK, of 29, Friesenstrasse, Bremen, Germany, a company incorporated according to the laws of the Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to materials, and to the production of materials, which are suitable for building purposes and are able to absorb part at least of the high energy of the radiation to which they are subjected.

In atomic decomposition or nuclear fission and in the radiation of cosmic energy, mixtures of rays of very high energy are produced. These mixtures consist of neutron rays, X-rays, γ-rays, other corpuscular rays and other high energy electromagnetic radiations. A material with an optimum layer thickness can be found having maximum absorption of each individual type of ray but generally such material is difficult to produce, and the production cost may be prohibitive. In the case of mixtures of rays such as are produced, for example, in atomic piles, in atomic explosions, in radio-active clouds and the like, it is difficult to create optimum conditions such that the absorption lies between 5% and 100%, without increasing production difficulties and/or impairing the quality of the material used.

It is particularly difficult to obtain optimum conditions in the case of a binding material or materials of magnesium oxide, magnesium chloride or cement (either singly or in combination), mixed with known aggregates. The mixture of binding material or materials with known aggregates will hereinafter be referred to as building material or materials.

A method according to this invention, comprises mixing with a building material or materials as described above at least one material as hereinafter defined capable of acting as a transformer for radiated energy for the purpose of converting radiation of high energy into radiation of lower energy, which radiation of lower energy can be absorbed in part at least by said building material or materials or by said transformer, whereby a composite material, suitable for use for building purposes and able to absorb by means of said conversion part at least of the high energy radiation to which it is subjected, is produced. A plurality of materials capable of acting as energy transformers may be mixed with said building material or materials for converting mixed radiation having a plurality of high energies into radiation having a corresponding plurality of lower energies and effecting step by step reductions in the energies of the radiation to which the composite material is subjected.

Suitable materials capable of acting as transformers for radiated energy according to this invention comprise one or more of the following:—

Paraffinic hydrocarbons, cadmium, cadmium oxide, cadmium sulphate or cadmium tungstate or other inorganic cadmium compounds but excluding binary compounds of cadmium and an element of Group VI *b* of the periodic table, inorganic selenium compounds but excluding the binary compounds of selenium and element of Group II of the periodic table, heavy metals and inorganic compounds of the heavy metals but excluding the sulphides, selenides and tellurides of bismuth, lead, arsenic, antimony or thallium. In this specification the term "heavy metal" denotes metals which can be precipitated by hydrogen sulphide in acid solution, e.g., lead, silver, gold, mercury, bismuth, copper, arsenic, antimony or thallium.

When one energy transformer is provided it may be such as to be able to convert any one of the following high energy rays:—

Neutron, X-, γ- or other corpuscular rays or other high energy electromagnetic radiation.

When a plurality of energy transformers are

[*Price 3s. 6d.*]

provided they may be such as to be able to convert a mixture of two or more of the following high energy rays:—

Neutron, X-, γ- or other corpuscular rays or other high energy electromagnetic radiation.

In the preferred arrangement using graduated energy transformers the high energy radiation is first absorbed in an energy transformer or transformers and excites characteristic radiation of a lower energy therein. The energy of this characteristic radiation is then absorbed in a further transformer or transformers and again a characteristic radiation of an even lower energy is excited, a quantum of high energy being in each case converted into quanta of a lower energy. Each individual energy transformer should act on a particular type of radiation and have a large absorptive cross-section, so that such transformers may be regarded as energy resonance transformers.

A high efficiency may be obtained by the use of graduated energy transformers, since the effective absorptive cross-section thus becomes considerably larger than in the case of a single absorber. Moreover, such graduated energy transformers are more efficient than a single transformer for converting a mixture of energy rays of various energies, especially if those energies or the constitution of the mixture cannot be pre-determined.

Composite materials produced in accordance with the invention may be in loose or solid form, and may be in slab, hollow block, or in any other form, while metal or fabric inserts may be employed for reinforcement.

The energy transformers may have the property of absorbing high-frequency energy especially in the wave range of from 100 cm. to 1 cm. and less. This is particularly important if the materials are employed as covering plates, either for transmitting stations, or for preventing reflection of irradiation.

In addition, the energy transformers may also have the property of absorbing or reflecting infra-red light, and/or substances having the property of absorbing or reflecting high frequency and/or infra-red rays may be admixed with the building materials in addition to the energy transformers.

Composite materials produced in accordance with the invention may be found to afford considerable protection against radiation when compared with materials hitherto employed. The building materials and/or energy transformers may at the same time be fireproof even when the composite material is able to be employed as a light-weight construction material. Moreover, the strength of the composite material need not be less than other building materials.

Composite materials in accordance with the invention may, with advantage, be employed in all cases where danger from radiated energy exists, that is to say, in clinics, in atomic factories, in air-raid shelters and in all other buildings which are to be protected against radiation and irradiation.

In our co-pending Application No. 12876/55 (Serial No. 804,157) we describe and claim a fire-proof protective coating wherein one or more pigment or pigments comprising one or more of the sulphides, selenides or tellurides of non-radioactive elements of the second group in the periodic table all of which are able to withstand high temperature and exhibit high reflection of infra-red rays in wavelengths between 0.8μ and 10μ is or are admixed with the binding material of which the coating is formed.

WHAT WE CLAIM IS:—

1. A method, comprising mixing with building material or materials as herein described at least one material as herein defined capable of acting as a transformer for radiated energy for the purpose of converting radiation of high energy into radiation of lower energy, which radiation of lower energy can be absorbed in part at least by said building material or materials or by said transformer, whereby a composite material, suitable for use for building purposes and able to absorb by means of said conversion part at least of the high energy radiation to which it is subjected, is produced.

2. Method according to Claim 1, wherein a plurality of materials capable of acting as energy transformers is mixed with said building material or materials for converting mixed radiation having a plurality of high energies into radiation having a corresponding plurality of lower energies and effecting step by step reductions in the energies of the radiation to which the composite material is subjected.

3. Method according to Claim 1 or Claim 2, wherein at least one energy transformer is able to convert one of the high energy rays:—

Neutron, X-, γ- or other corpuscular rays or other high energy electromagnetic radiation.

4. Method according to Claim 2, wherein the plurality of energy transformers comprises transformers able to convert a mixture of two or more of the following high energy rays:—

Neutron, X-, γ- or other corpuscular rays or other high energy electromagnetic radiation.

5. A composite material comprising a mixture of a building material or materials as herein described and at least a material as herein defined capable of acting as a transformer for radiated energy for the purpose of converting radiation of high energy into radiation of lower energy which radiation of lower energy can be absorbed in part at least by said building material or materials or by said transformer, said composite material being suitable for use for building purposes and able to absorb by means of said conversion part at least of the high energy radiation to which it is subjected.

6. Composite material according to Claim 5, in which a plurality of materials capable of

acting as energy transformer is mixed with said building material or materials for converting mixed radiation having a plurality of high energies into radiation having a corresponding plurality of lower energies and effecting step by step reductions in the energies of the radiation to which the composite material is subjected.

7. Composite material according to Claim 5 or Claim 6, in which at least one energy transformer is able to convert one of the following high energy rays:—

Neutron, X-, γ- or other corpuscular rays or other high energy electromagnetic radiation.

8. Composite material according to Claim 6, in which the plurality of energy transformers comprises transformers able to convert a mixture of two or more of the following high energy rays:—

Neutron, X-, γ- or other corpuscular rays or other high energy electromagnetic radiation.

9. Composite material according to any one of Claims 5 to 8, wherein the building material or materials and/or the energy transformers are fireproof materials.

10. Composite material according to any one of Claims 5 to 9, wherein metallic and/or fabric reinforcements are provided.

11. Composite material according to any one of Claims 5 to 10, in which the energy transformers have high frequency energy absorbing properties, and/or in which high frequency energy absorbing materials are admixed.

12. Composite material according to any one of Claims 5 to 11, in which the energy transformers have infra-red ray absorbing or reflecting properties, and/or in which materials having infra-red ray absorbing or reflecting properties are admixed.

13. Method according to Claim 1 of producing a composite material suitable for use for building purposes and able to absorb part at least of the high energy radiation to which it is subjected substantially as described herein.

14. Composite material according to Claim 5 suitable for use for building purposes and able to absorb part at least of the high energy radiation to which it is subjected substantially as described herein.

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